Molecular precursors of the RNA-world in the interstellar medium

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The question of the origin of Life has intrigued human beings for centuries. We still do not understand how simple molecules combine together to form large molecules essential for living organisms. Recent prebiotic experiments, based on the RNA-world hypothesis for the origin of Life, have suggested that the three basic macromolecular systems (nucleic acids, proteins and lipids) could have formed from relatively simple precursors. The detection of some of these molecules in space, thanks to the unprecedented capabilities of current astronomical facilities, has opened a new window for Astrobiology from the Astrochemical point of view.

In this talk I will present an overview of the most recent results of a ultradeep unbiased spectral survey towards the Galactic Center molecular cloud G+0.693-0.027 with the Yebes 40m and the the IRAM 30m telescopes. Among the more than 120 molecules detected, we have discovered in the last three years 9 new interstellar species towards this cloud (see Figure 1). These molecules include key precursors of RNA nucleotides such as hydroxylamine [1] (NH_2OH) or cyanomethanimine [2] (HNCHCN), proteins, such as ethyl isocyanate [3] (C_2H_5NCO), and lipids, such as ethanolamine [4] ($NH_2CH_2CH_2OH$). This amazing chemical complexity, which might be only the tip of the iceberg, means that interstellar chemistry offers an extremely rich feedstock for triggering prebiotic chemistry.

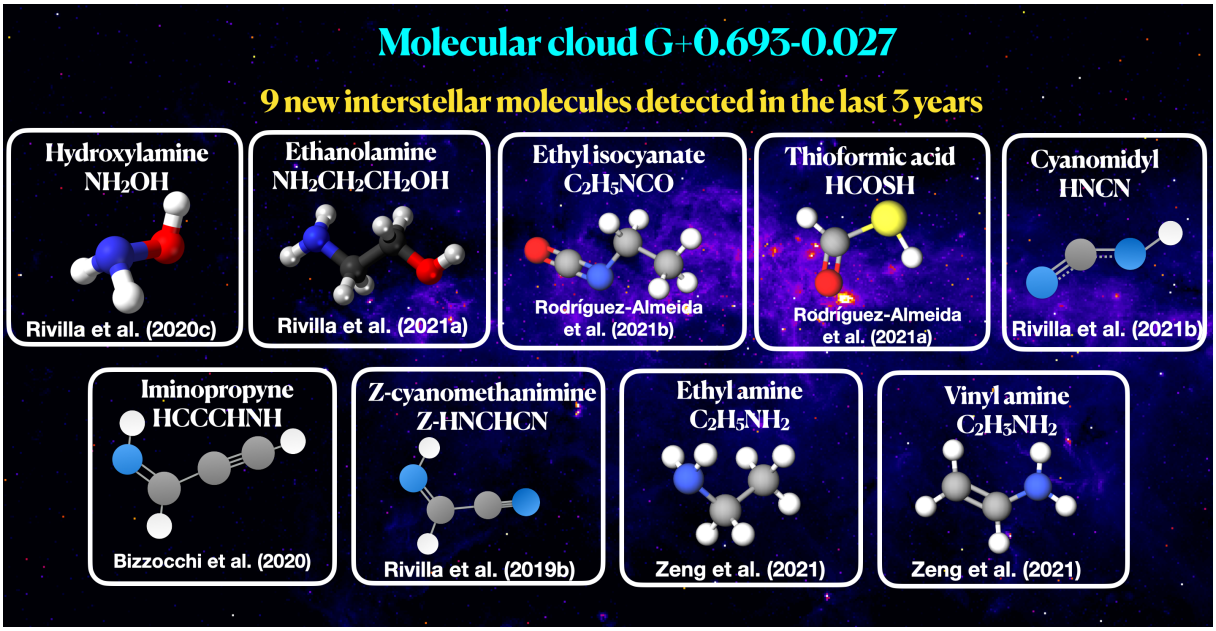

Figure 1: New interstellar molecules detected towards the molecular cloud G+0.693-0.027 using a deep unbiased spectral survey conducted with the Yebes 40m and IRAM 30m telescope.

References

[1] V. M. Rivilla, et al. 2020c, The Astrophysical Journal Letters, 899, id.L28
[2] V.M. Rivilla et al. 2019b, Monthly Notices of the Royal Astronomical Society Letters, 483, p.L114-L119
[3] L. F. Rodríguez-Almeida, Astronomy & Astrophysics, 654, id.L1
[4] V. M. Rivilla, et al. 2021a, PNAS, 118, id. 2101314118